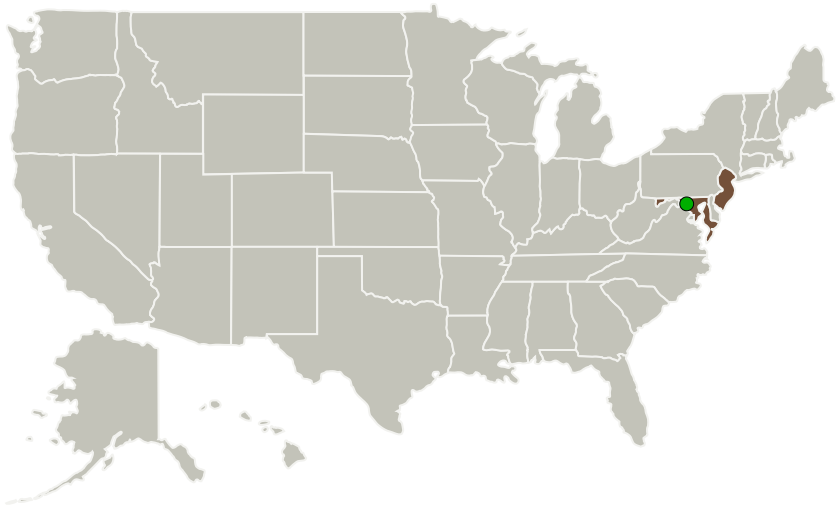
Low-Noise Analog APDs with Impact Ionization Engineering and Negative Feedback, Phase I

Completed Technology Project (2012 - 2012)

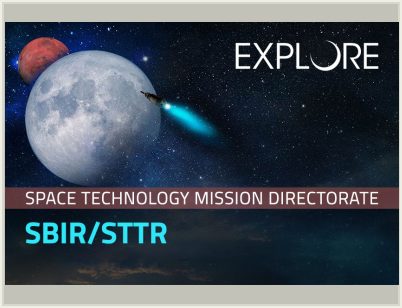
Project Introduction

Future NASA LIDAR missions require low noise and large area photodetectors operated at short-wave infrared (SWIR) wavelengths. Silicon avalanche photodiodes have very low responsivity for wavelength longer than 1.1 um; and while InP-based APDs have high responsivity in the SWIR region, they exhibit high noise equivalent powers (NEPs) due to the relatively high excess noise of bulk InP multiplication regions. We propose to develop low-noise analog APDs operating in the SWIR region by incorporating impact ionization engineered structures coupled with an epitaxial negative feedback gain quenching mechanism into the multiplication region of linear mode APDs. The goal is to develop large-area (>250 um diameter), low-noise SWIR detectors with high quantum efficiency (>75%), high bandwidth (~100 MHz), and very low NEP approaching NASA targets of 20 fW/rt(Hz). In addition to discrete device characterization, these devices will be incorporated into prototype LIDAR receivers for performance assessment.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Princeton Lightwave, Inc.	Lead Organization	Industry	Cranbury, New Jersey
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland



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Primary U.S. Work Locations	
Maryland	New Jersey

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138277)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Princeton Lightwave, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

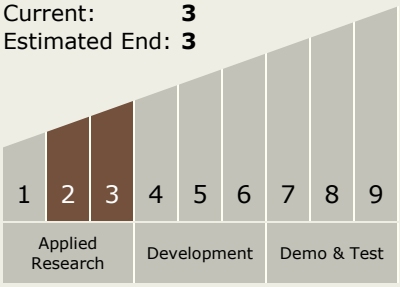
Carlos Torrez

Principal Investigator:

Xudong Jiang

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Completed Technology Project (2012 - 2012)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System